

**CLAIMS**

I claim:

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1. A wireless space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates comprising:

a first modem means and a second modem means interconnected by a conventional wireless telecommunications link, whereby each of said first modem means and second modem means further comprises:

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(a) single antenna means;

(b) two or more multiple input/multiple output (MIMO) space-time wireless transceiver means;

(c) an antenna array reduction or expansion chamber associated with said two or more MIMO space-time wireless transceivers; and

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(d) a frequency spectrum shifting module associated with said two or more MIMO space-time wireless transceivers;

whereby said first modem means and said second modem means act as a high speed transmitter and a high speed receiver of data transferred between two user interfaces through the conventional wireless telecommunications link.

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2. The space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 1, wherein said first modem acts as a space-time transmitter, and further includes one or more output channels, at least one of which transmits forward correction coding.

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3. The space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 2, wherein said one or more output channels includes a back channel which receives  
5 feedback from said second modem means relating to said forward correction coding, and thereby receives signal to noise information and bit error rate information to facilitate requests to retransmit corrupt data packets.

4. The space-time fast modem system for transmitting data between  
10 two or more user interfaces at high transfer rates according to claim 1, wherein said second modem acts as a space-time receiver, and further includes one or more input channels, at least one of which receives forward correction coding transmitted by said first modem means.

5. The space-time fast modem system for transmitting data between  
15 two or more user interfaces at high transfer rates according to claim 4, wherein at least one of said input channels is used to receive error information, analyze said error information and transfer a continuous space-time training sequence as a means to allow for reduction of channel common mode noise and compensation  
20 for doppler frequency shift and doppler spread without impacting channel capacity in high speed mobile applications.

6. The space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 1, wherein  
25 said two or more multiple input/multiple output (MIMO) space-time wireless transceiver means, includes conventional interface electronics to make said transceivers compatible with existing industry standard protocols.

7. The space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 1, wherein  
5 said antenna array reduction or expansion chamber associated with said two or more MIMO space-time wireless transceivers includes outside shielding to prevent adverse electromagnetic interference and to prevent said MIMO space-time transceivers from generating interference adverse to other radio systems.

10 8. The space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 1, wherein said antenna array reduction or expansion chamber associated with said two or more MIMO space-time wireless transceivers includes one or more input antennas  
15 and one or more transmission antennas, whereby the number of input antennas is greater than the number of transmission antennas within any given antenna array.

20 9. The space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 1, wherein said antenna array reduction or expansion chamber is replaced by a digital signal processing (DSP) processor for the purpose of creating a unique scattering rich space-time signature to aid in the separation of signals among the input antennas within said antenna array.

25 10. The space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 1, wherein

said frequency spectrum shifting module includes a down converter when associated with the first modem means, the transmitting modem, for the purpose shifting the frequency spectrum from microwave to a lower spectrum, down to base-band, in order to make said first modem compatible with standard carrier frequencies of existing infrastructure.

11. The space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 10, wherein said down converter includes an oscillator with a frequency expressed as:

$$F_{fssm} = F_{vco} - F_c$$

where  $F_{fssm}$  is the frequency of the frequency spectrum shift module,  $F_{vco}$  is the frequency of the voltage control oscillator frequency, and  $F_c$  is the carrier frequency, whereby the voltage controlled oscillator is a component of said first modem means, the transmitter modem.

12. The space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 1, wherein said multiple input/multiple output (MIMO) space-time wireless transceiver means utilize a single input/single output (SISO) repeater, or two or more SISO repeaters in series, to extend its operating distance range.

13. A hard wired space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates comprising: a first modem means and a second modem means interconnected by a conventional hard wired telecommunications link, whereby each of said first modem means and second modem means further comprises:

(a) single antenna means;

- (b) two or more multiple input/multiple output (MIMO) space-time wireless transceiver means;
- (c) an antenna array reduction or expansion chamber associated with said two or more MIMO space-time wireless transceivers; and
- (d) a frequency spectrum shifting module associated with said two or more MIMO space-time wireless transceivers;

whereby said first modem means and said second modem means act as a high speed transmitter and a high speed receiver of data transferred between two user interfaces through the conventional hard wired telecommunications link.

14. The space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 13, wherein said first modem acts as a space-time transmitter, and further includes one or more output channels, at least one of which transmits forward correction coding.

15. The space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 14, wherein said one or more output channels includes a back channel which receives feedback from said second modem means relating to said forward correction coding, and thereby receives signal to noise information and bit error rate information to facilitate requests to retransmit corrupt data packets.

16. The space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 13, wherein said second modem acts as a space-time receiver, and further includes one or

more input channels, at least one of which receives forward correction coding transmitted by said first modem means.

17. The space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 16, wherein at least one of said input channels is used to receive error information, analyze said error information and transfer a continuous space-time training sequence as a means to allow for reduction of channel common mode noise and compensation for doppler frequency shift and doppler spread without impacting channel capacity in high speed mobile applications.

18. The space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 13, wherein said two or more multiple input/multiple output (MIMO) space-time wireless transceiver means, includes conventional interface electronics to make said transceivers compatible with existing industry standard protocols.

19. The space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 13, wherein said antenna array reduction or expansion chamber associated with said two or more MIMO space-time wireless transceivers includes outside shielding to prevent adverse electromagnetic interference and to prevent said MIMO space-time transceivers from generating interference adverse to other radio systems.

20. The space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 13, wherein said antenna array reduction or expansion chamber associated with said two or

more MIMO space-time wireless transceivers includes one or more input antennas and one or more transmission antennas, whereby the number of input antennas is greater than the number of transmission antennas within any given antenna array.

5                    21.     The space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 13, wherein said antenna array reduction or expansion chamber is replaced by a digital signal processing (DSP) processor for the purpose of creating a unique scattering rich space-time signature to aid in the separation of signals among the input antennas  
10                    within said antenna array.

                    22.     The space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 13, wherein said frequency spectrum shifting module includes a down converter when  
15                    associated with the first modem means, the transmitting modem, for the purpose shifting the frequency spectrum from microwave to a lower spectrum, down to base-band, in order to make said first modem compatible with standard carrier frequencies of existing infrastructure.

20                    23.     The space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 22, wherein said down converter includes an oscillator with a frequency expressed as:

$$F_{fssm} = F_{vco} - F_c$$

                    where  $F_{fssm}$  is the frequency of the frequency spectrum shift module,  $F_{vco}$  is the  
25                    frequency of the voltage control oscillator frequency, and  $F_c$  is the carrier frequency, whereby the voltage controlled oscillator is a component of said first modem means, the transmitter modem.

24. The space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 13, wherein  
5 said multiple input/multiple output (MIMO) space-time wireless transceiver means utilize a single input/single output (SISO) repeater, or two or more SISO repeaters in series, to extend its operating distance range.

25. A method for making a wireless space-time fast modem system for  
10 transmitting data between two or more user interfaces at high transfer rates comprising the steps of:

providing a first modem means and a second modem means interconnected by a conventional wireless telecommunications link, whereby each of said first modem means and second modem means further comprises:

- 15 (a) single antenna means;
- (b) two or more multiple input/multiple output (MIMO) space-time wireless transceiver means;
- (c) an antenna array reduction or expansion chamber associated with said two or more MIMO space-time wireless transceivers; and
- 20 (d) a frequency spectrum shifting module associated with said two or more MIMO space-time wireless transceivers;

whereby said first modem means and said second modem means act as a high speed transmitter and a high speed receiver of data transferred between two user interfaces through the conventional wireless  
25 telecommunications link.



26. The method for making a wireless space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 25, wherein said step of providing first and second modem means includes said first modem acting as a space-time transmitter, and further  
5 includes the generation of one or more output channels by said first modem, at least one of which output channels transmits forward correction coding.

27. The method for making a wireless space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates  
10 according to claim 26, wherein said step of generating said one or more output channels includes the generation of a back channel which receives feedback from said second modem means relating to said forward correction coding, and thereby receives signal to noise information and bit error rate information to facilitate requests to retransmit corrupt data packets.

28. The method for making a wireless space-time fast modem system for transmitting between two or more user interfaces at high transfer rates according to claim 25, wherein said step of providing first and second modem means includes providing said second modem means to act as a space-time  
20 receiver, where said second modem means includes one or more input channels, at least one of which receives forward correction coding transmitted by said first modem means.

29. The method for making a wireless space-time fast modem system  
25 for transmitting between two or more user interfaces at high transfer rates according to claim 28, wherein said step of providing input channels further includes at least one of said input channels used to receive error information,

analyze said error information and transfer a continuous space-time training sequence as a means to allow for reduction of channel common mode noise and compensation for doppler frequency shift and doppler spread without impacting channel capacity in high speed mobile applications.

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30. The method for making a wireless space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 25, wherein said step of providing first and second modem means further includes providing said first and second modem means wherein  
10 said two or more multiple input/multiple output (MIMO) space-time wireless transceiver means includes conventional interface electronics to make said transceivers compatible with existing industry standard protocols.

15 31. The method for making a wireless space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 25, wherein said step of providing first and second modem means further includes providing said first and second modem means wherein  
20 said antenna array reduction or expansion chamber associated with said two or more MIMO space-time wireless transceivers includes outside shielding to prevent adverse electromagnetic interference and to prevent said MIMO space-time transceivers from generating interference adverse to other radio systems.

25 32. The method for making a wireless space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 25, wherein said step of providing first and second modem means further includes providing said antenna array reduction or expansion

chamber associated with said two or more MIMO space-time wireless transceivers including one or more input antennas and one or more transmission antennas, whereby the number of input antennas is greater than the number of transmission antennas within any given antenna array.

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33. The method for making a wireless space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 25, wherein said step of providing first and second modem means further includes providing replacing said antenna array reduction or expansion chamber by a digital signal processing (DSP) processor for the purpose of creating a unique scattering rich space-time signature to aid in the separation of signals among the input antennas within said antenna array.

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34. The method for making a wireless space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 25, wherein said step of providing first and second modem means further includes providing said frequency spectrum shifting module including a down converter when associated with the first modem means, the transmitting modem, for the purpose shifting the frequency spectrum from microwave to a lower spectrum, down to base-band, in order to make said first modem compatible with standard carrier frequencies of existing infrastructure.

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35. The method for making a wireless space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates

according to claim 34, wherein said step of providing said down converter includes providing a down converter having an oscillator with a frequency expressed as:

$$F_{fssm} = F_{vco} - F_c$$

5 where  $F_{fssm}$  is the frequency of the frequency spectrum shift module,  $F_{vco}$  is the frequency of the voltage control oscillator frequency, and  $F_c$  is the carrier frequency, whereby the voltage controlled oscillator is a component of said first modem means, the transmitter modem.

10 36. The method for making a wireless space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates according to claim 25, wherein said step of providing first and second modem means further includes providing first and second modem means including said multiple input/multiple output (MIMO) space-time wireless transceiver  
15 means which utilize a single input/single output (SISO) repeater, or two or more SISO repeaters in series, to extend its operating distance range.

20 37. A method for making a hard wired space-time fast modem system for transmitting data between two or more user interfaces at high transfer rates comprising the steps of:

providing a first modem means and a second modem means interconnected by a conventional hard wired telecommunications link, whereby each of said first modem means and second modem means further comprises:

- 25 (a) single antenna means;
- (b) two or more multiple input/multiple output (MIMO) space-time wireless transceiver means;

- (c) an antenna array reduction or expansion chamber associated with said two or more MIMO space-time wireless transceivers; and
- (d) a frequency spectrum shifting module associated with said two or more MIMO space-time wireless transceivers;

5       whereby said first modem means and said second modem means act as a high speed transmitter and a high speed receiver of data transferred between two user interfaces through the conventional hard wired telecommunications link.

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